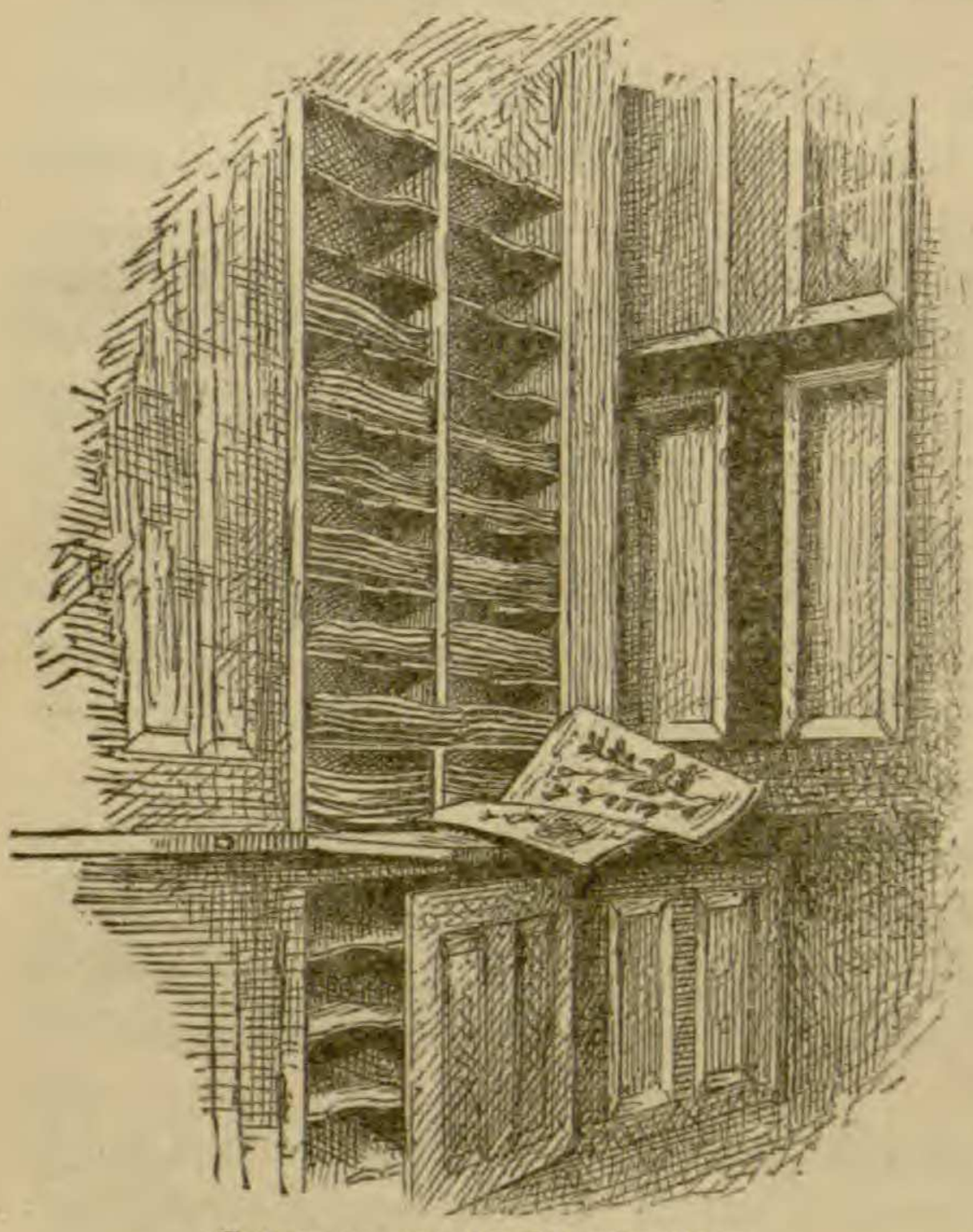
VOL. XIV. NO. 1.—BOTANICAL GAZETTE.—JAN., 1889.

Botany in the University of Pennsylvania.

(WITH PLATES I-V.)

The year 1860 saw the United States without a single botanical laboratory. It is true that in Philadelphia there was the herbarium of the Philadelphia Academy of Natural Sciences, and that in New York City the Torrey herbarium stood open to all properly accredited students; and also in Cambridge the greatest of all American herbaria and greatest of all our systematists and best of men, Asa Gray, welcomed students who came with serious intentions. But there was nothing corresponding to the laboratories of the old world, where the whole science of botany could be studied under thoroughly trained men.



CORNER OF THE HERBARIUM.

Twenty-five years later, the condition of affairs had so changed that we had a number of fairly appointed laboratories. In earlier times, if one desired to become proficient in tracing the life histories of the lower forms of plant-life, if he wished to follow the development and evolution of tissues, or to study vegetable physiology, there was nothing for him to do save to go abroad. Such a condition of affairs, in a country whose growth and material prosperity was the marvel of the century, was not only lamentable, but it was disgraceful.

We now have not only laboratories, but we have American students, trained abroad, to direct them. One thing yet we lack. It is the full recognition of the fact that the highest function of a laboratory is to increase knowledge, and that to do this the professors should have ample time and be

relieved of most of the drudgery of teaching. This, however, is only a question of a few years; for in nothing desirable can this country afford to suffer by comparison.

The latest laboratory we illustrate in this number. It is that of the University of Pennsylvania. This is the outgrowth of a long series of very slow steps. In the early part of this century, Doctor William P. C. Barton, surgeon in the United States navy, was made professor of botany. Though he was a zealous man, and, for the times, well fitted for his work, he left almost no impress upon the teaching of the institution in botany. We can hardly think the failure is attributable to him.

In the year 1865, the late distinguished George B. Wood, with a liberality as rare as it was praiseworthy, partially endowed, under the title of the Auxiliary Faculty of Medicine, five chairs. Among these was one of botany. It is true that neither the salary nor the duties of the incumbent were very large. His pay never, under the endowment, exceeded five hundred dollars a year, nor was he expected to do more than deliver thirty-five lectures for that sum. It is true, all that the professor of botany did beyond this was fully appreciated by the authorities, but it can hardly be said to have opened any avenue for promotion, because no avenue was possible under the circumstances.

The first professor of botany under this endowment was Horatio C. Wood, M. D., who was then distinguishing himself as a pioneer fresh-water algologist, and who afterwards won even higher honors in the field of materia medica and therapeutics.

Professor Wood resigned his position in 1876, and Dr. J. T. Rothrock was, on the suggestion of Professor Asa Gray, chosen to succeed him. The liberality of the late Eli K. Price made it possible to obtain some dissecting microscopes and to open a laboratory for analytical work. Beyond this nothing could be accomplished, until the year 1881, when the University, recognizing, at last, the need of more extended botanical instruction, established a full chair of botany, and undertook to provide a course of instruction preparatory to medical study. The idea was a good one, but there were insuperable difficulties in the way of its largest success.

In 1883, the accident of two ladies (one coming from China) desiring to study the natural sciences in Philadelphia, and finding in that great city of a million inhabitants no place where they could receive regular instruction, opened the

eyes of the community to its educational shortcomings. Funds were at once raised for a Biological school under the auspices of the University of Pennsylvania, in which the same privileges were to be accorded to both sexes. This was the very foundation-stone, the leading principle, out of which the new movement took final shape. It should also be added, it was fortunate that Prof. Horace Jayne, M. D., was made secretary. But for the gift of his time, his executive ability and his money, the fullness of hope might have been long deferred.

Plate I gives a northern view of a three-story brick building, 82 x 47 feet. A glance will show that, though nothing has been wasted upon mere architectural effect, the more important consideration of light for work has been fully considered. We may also add that upon its heating arrangement and water supply great attention has been bestowed.

Plate II shows the interior of the laboratory of general biology, seen from the east. This room, capable of seating fifty students comfortably, and providing for all the appliances of work, is now regularly filled with an attentive and promising class derived from the biological and veterinary schools; from the college and from the auxiliary medical course. The same room is used for general biology and for botany. In other words, it is the work-shop of the first-year students. The advantage of this plan is that each student can thus receive a simple and a compound microscope, a full set of staining and micro-chemical reagents, and be held strictly responsible for them. Each man has exclusively the key to a safe-lock closet. On entering, he deposits a moderate sum to cover breakage, etc. After deducting his indebtedness, the remainder is returned to him at the end of the season.

The long gas-pipe seen overhead and the jets along the front wall supply to each worker means of applying heat or receiving light as he may require.

In the first term of the first year the entire class attends the laboratory instruction of Prof. W. P. Wilson on the gross anatomy of plants, and later on receives lectures upon the elements of vegetable physiology from the same gentleman. He also gives instruction upon describing plants.

In the second term of the first year the students have instruction from Prof. J. T. Rothrock in analysis of our common plants. This work is, by choice, on dried plants. The systematist in botany will always be obliged to do much of

his labor from similar material, and it is well worth the while of the student to learn how it is done.

The botany of the first term of the second year is histological and physiological. For this class a special laboratory is provided, adjoining the room where the general work of the second year is done. Plate III shows, unfortunately, but a corner of the physiological laboratory. Here one finds abundance of aquaria, large and small, the usual supply of tubing, test-tubes, air-pumps, etc. In fact, the desire is to furnish whatever is needed for working out the usual problems of this stage of botanical study. Prof. Wilson has arranged a very satisfactory course of practical instruction in this direction.

The physiological laboratory communicates also with the greenhouse (Plate IV), in which abundance of fresh material is found.

The second term of the second year brings the student to Prof. Rothrock for some of the practical aspects of botany. He may decide for himself what direction his study shall take. Most of the students prefer medical botany, as it is directly in the line of the profession into which the vast majority of them ultimately go. Or the opportunity is given for close study of different kinds of work, or the student may prefer *general economic* botany.

There are beside special rooms provided for these advanced students who are capable of doing original work.

Miss Emily L. Gregory, who is so well known to the readers of the GAZETTE, is now engaged in pursuing her investigations in this building. Plate V shows one of these laboratories for special workers.

In the building there is a very complete local herbarium, the gift of Mr. Isaac Burk. The herbarium owned by Prof. Rothrock is here and available for purposes of study. It has a value from the large number of the type specimens of our western species which it contains. Among them are found sets of the collections made by the earlier government explorations west of the Mississippi. Also those of Bolander, Parry, Hall and Harbour, Lemmon, Palmer, Rothrock and Pringle. The small illustration heading this article shows a corner in the herbarium.

The student also has access, under proper restrictions, to the facilities for study offered by the Philadelphia Academy of Natural Sciences. The library and herbarium of that institution are among the most valuable in the country.

The botanical garden is now fairly started, and already

adds very considerably to the teaching resources of the institution. Steps are being taken for its immediate enlargement.

The advances made in the recent past by the photographic art suggested that the biological school should not only have a place provided where it could take advantage of the help there afforded in illustration, but where photography, as applied to scientific work, could be taught.

During the past season the results in this direction have amply confirmed the opinion as to the value of photography in botany, both for reproducing microscopic appearances and for the larger visions of field work.

Development of cork-wings on certain trees. IV.

EMILY L. GREGORY.

Physiology.

The question of function can only be raised here, in case this peculiarity of structure is sufficiently emphatic to render it probable that some special object is to be gained from it. Assuming this to be true, the difference in the morphology of the three kinds described suggests a corresponding difference in function. In connection with this, two important principles held by scientists of the present day are to be considered. First, that no peculiarity of structure in living organisms is supposed to exist without adequate cause. For example, the wings of Euonymus alatus, which appear to the ordinary observer as useless if not cumbersome appendages, may be accounted for as a result of an effort on the part of its ancestors to accommodate themselves to their environment. According to this, it is not necessary, however, to show that an organ which proved advantageous to the ancestors of this plant is of equal service now to the offspring, unless it can be shown that the circumstances which called it into existence are still unchanged.

The second principle is that nature is extremely sparing of material; that of all the various means made use of to attain an end, those requiring the least outlay of material are the ones retained, and peculiarities of structure arising in harmony with this principle are the ones transmitted by inheritance.

Assuming the validity of these two principles, it would seem a proper question to ask: Of what use to these plants